Audio processor - companding and amplifier section NE/SA5750

DESCRIPTION

The NE/SA5750 is a high performance low power audio signal processing system. The NE/SA5750 subsystems include a low noise microphone preamplifier with adustable gain, a noise cancellation switching amplifier with adjustable threshold, a voice operated transmitter (VOX) switch, VOX control, an audio compressor with buffered input, audio expandor, a unity gain power amplifier to drive a speaker, a summing power amplifier for sidetone attenuation and headphone (earpiece) drive, and an internal bandgap voltage regulator with power down capability. When used with Philips Semiconductors NE/SA5751, the complete audio processing function of an AMPS or TACS cellular telephone is easily implemented. The NE/SA5750 can also be used without the NE/SA5751 in a wide variety of radio communications applications.

FEATURES

- High performance
- 5V supply
- Adjustable VOX and noise cancellation threshold
- Adjustable gain preamplifier
- Audio companding
- ESD protected
- Open collector VOX output
- Logic inputs CMOS compatible
- Power down mode
- Built-in drivers for speaker and earpiece
- Few external components
- SOL and DIP packages

PIN CONFIGURATION

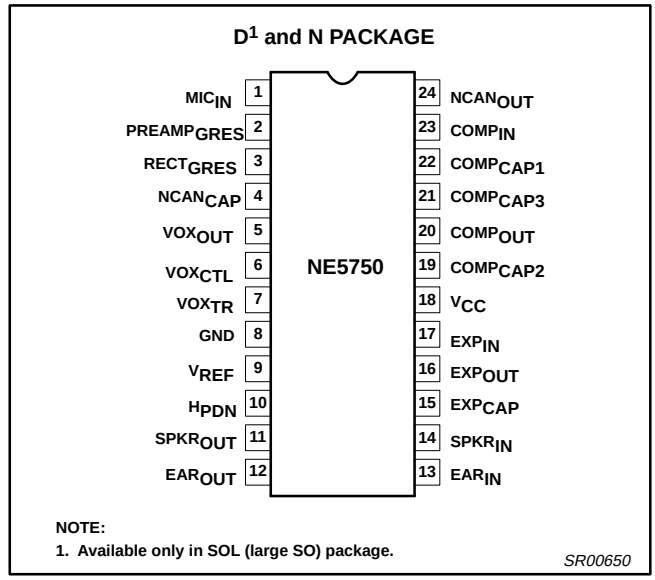

Figure 1. Pin Configuration

BENEFITS

- Very compact applications
- Long battery life in portable equipment
- Complete cellular audio function with the SA5751

APPLICATIONS

- Cellular radio
- Mobile communications
- High performance cordless telephones
- 2-way radio

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
24-Pin Plastic Dual In-Line Package (DIP)	0 to +70°C	NE5750N	SOT248-1
24-Pin Plastic Small Outline Large (SOL) package	0 to +70°C	NE5750D	SOT137-1
24-Pin Plastic Dual In-Line Package (DIP)	-40 to +85°C	SA5750N	SOT248-1
24-Pin Plastic Small Outline Large (SOL) package	-40 to +85°C	SA5750D	SOT137-1

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Power supply voltage Voltage applied to any pin	6 -0.3 to (V_{CC} + 0.3)	V V
T_{STG}	Storage temperature	-65 to +150	°C
T_A	Ambient operating temperature NE5750 SA5750	 0 to 70 -40 to +85	°C

PIN DESCRIPTIONS

PIN NO.	SYMBOL	DESCRIPTION
1	MIC_{IN}	Microphone input
2	$PREAMP_{GRES}$	Preamplifier gain resistor
3	$RECT_{GRES}$	Reactifier gain resistor
4	$NCAN_{CAP}$	Noise cancellation timing capacitor
5	VOX_{OUT}	Voice operated transmission output
6	VOX_{CTL}	Voice operated transmission control
7	VOX_{TR}	Voice operated transmission threshold resistor
8	GND	Ground
9	V_{REF}	Reference voltage
10	H_{PDN}	Hardware power down
11	$SPKR_{OUT}$	Speaker output
12	EAR_{OUT}	Earpiece output
13	EAR_{IN}	Earpiece input, side tone input
14	$SPKR_{IN}$	Speaker input
15	EXP_{CAp}	Expandor timing capacitor
16	EXP_{OUT}	Expandor output
17	EXP_{IN}	Expandor input
18	V_{CC}	Positive supply
19	$COMP_{CAP2}$	Compressor timing capacitor 2
20	$COMP_{OUT}$	Compressor output
21	$COMP_{CAP3}$	Compressor timing capacitor 3
22	$COMP_{CAP1}$	Compressor timing capacitor 1
23	$COMP_{IN}$	Compressor input
24	$NCAN_{OUT}$	Noise cancellation output

BLOCK DIAGRAM

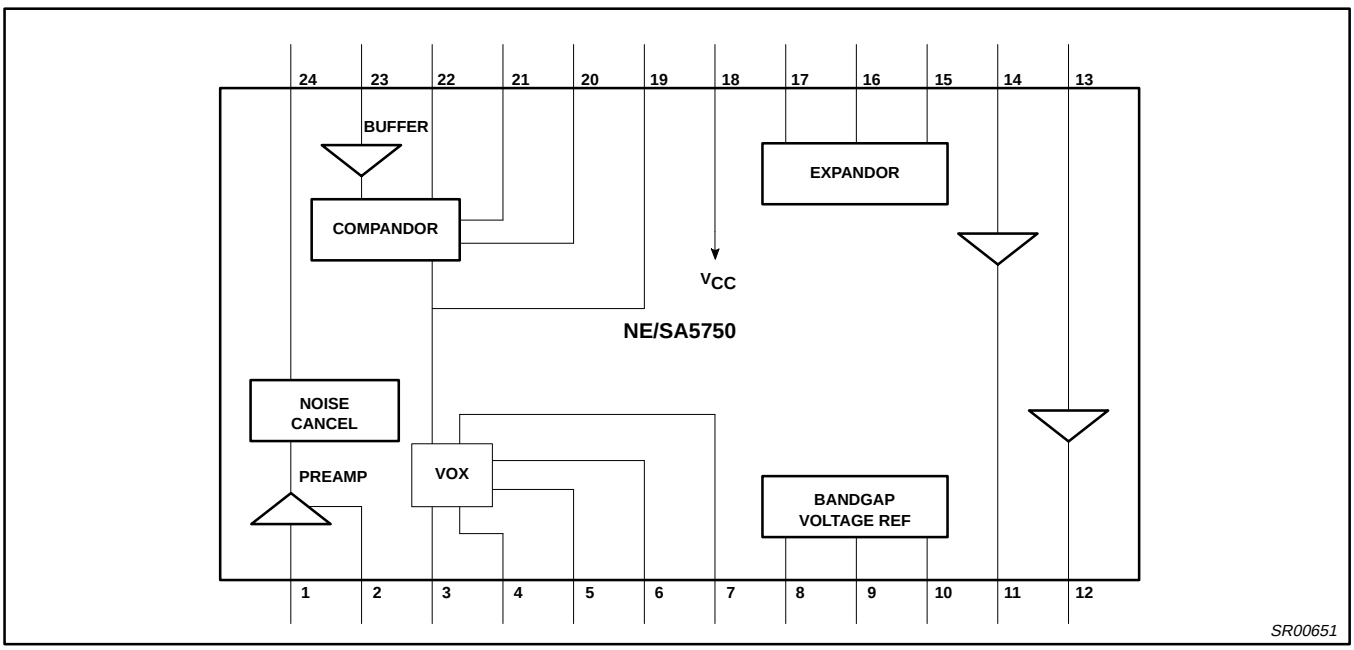

Figure 2. Block Diagram

DC ELECTRICAL CHARACTERISTICS

$T_A = 25^oC$, V_{CC} = +5.0V, 0dB = 77.5mV_{RMS}. See test circuit, Figure 6.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
V_{CC}	Supply voltage		4.75	5.0	5.25	V
I_{CC}	Supply current	No signal Power down mode		8.4 1.8	12.0 3.0	mA mA
Z_L	Load impedance pins $NCAN_{OUT}$, EXP_{OUT}		50			kΩ
	$COMP_{OUT}$[1]		10			kΩ
Z_{IN}	Input impedance $COMP_{IN}$, MIC_{IN}, $SPKR_{IN}$		40	50	60	kΩ
	EXP_{IN}[2]		2.0	2.5		kΩ
	Noise cancellation current[4]	Pin 7, grounded	40	50	60	μA
V_{OS}	DC offset $NCAN_{OUT}$[3]		-50		50	mV

NOTES:
1. Compressor is tested in production with 50kΩ load.
2. Not tested in production.
3. Offset values are identical for both gain states of noise reduction circuit.
4. VOX threshold resistor at Pin 7, R3, should be greater than 3kΩ.

AC ELECTRICAL CHARACTERISTICS

$T_A = 25^oC$, V_{CC} = +5.0V, 0dB level = 77.5mV_{RMS}. See test circuit, Figure 6.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
	Preamplifier gain range Preamplifier voltage gain 0dB Preamplifier voltage gain 40dB	 Pin 2 open Pin 2 AC ground	0 -1.0 39.0	 0 40	40 1.0 41.0	dB dB dB
	Preamplifier noise density	Pin 2 AC grounded RS = 0 - 50kΩ unweighted 20Hz-20kHz		7		$nV/\sqrt{Hz}$
		weighted CCIR DIN45405 20-20kHz		8		
	Switch amplifier gain		9	10	11	dB
	Sidetone attenuation range				30	dB
Compandor 1kHz, all tests[1]						
$COMP_{OUT}$	Compressor error at -21dB output level	Input level = -42dB		0.38		dB
$COMP_{OUT}$	Compressor error at -10dB output level	Input level = -20dB	-1.0		1.0	dB
$COMP_{OUT}$	Compressor error at 0dB output level	Input level = 0dB	-1.5	0.12	1.5	dB
$COMP_{OUT}$	Compressor error at +5dB output level	Input level = +10dB	-1.0		1.0	dB
$COMP_{OUT}$	Compressor error at +12.3dB output level	Input level = +24.6dB	-1.0		1.0	dB
EXP_{OUT}	Expandor error at -42dB output level	Input level = -21dB		-0.41		dB
EXP_{OUT}	Expandor error at -21dB output level	Input level = -10.5dB	-1.0		1.0	dB
EXP_{OUT}	Expandor error at -10dB output level	Input level = -5dB	-1.0		1.0	dB
EXP_{OUT}	Expandor error at 0dB output level	Input level = 0dB	-1.5	-0.18	1.5	dB
EXP_{OUT}	Expandor error at +10dB output level	Input level = +5dB	-1.0		1.0	dB
EXP_{OUT}	Expandor error at +24.6dB output level[2]	Input level = +12.3dB	-1.5		1.5	dB
EXP_{OUT}	Expandor V_{OS}	No signal	-50.0		50.0	mV
EXP_{OUT}	Expandor output DC shift	No signal to 0dB	-100		100	mV

AC ELECTRICAL CHARACTERISTICS

T_A = 25°C, V_{CC} = +5.0V, 0dB level = 77.5mV_{RMS}. See test circuit, Figure 6.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
	Timing capacitors compandor			2.2		µF
THD	Total harmonic distortion					%
	Compressor	1kHz, 0dB		0.09	1	
	Expandor	1kHz, 0dB		0.09	1	
	$NCAN_{OUT}$	1kHz. Pin 2 open output level = 0dB		0.18	1	
		1kHz, Pin 2 open output level = +25dB		0.13	1	
	Speaker amplifier Drive capability				40	mA_{P-P}
	Output swing (<1% THD)	50Ω load	2	3.2		V_{P-P}
		100Ω load	3	4.1		V_{P-P}
		No load	4	4.9		V_{P-P}
	Ear amplifier Drive capability				10	mA_{P-P}
	Output swing (<1% THD)	300Ω load	3	4.3		V_{P-P}
		2000Ω load	4	4.9		V_{P-P}
		No load	4	4.9		V_{P-P}
VOX_{OUT}	Sink current				0.5	mA
	Low level High level	Open collector I_L = 0.5mA	 4	0.07 5	0.4	V V
VOX_{CTL}	Input current Low		-50	-21	0	µA
	High		-10		+10	µA
	Input level Low High		0 3.5		1.5 5	V V
H_{PDN}	Input current Low		-10		+10	µA
	High		-10		+10	µA
	Input level Low High		0 3.5		1.5 5	V V
	Reference filter capacitor			10		µF

NOTE:
1. Measurements are relative to 0dB output.
2. Measurement is absolute and indicative of the output dynamic range capability.

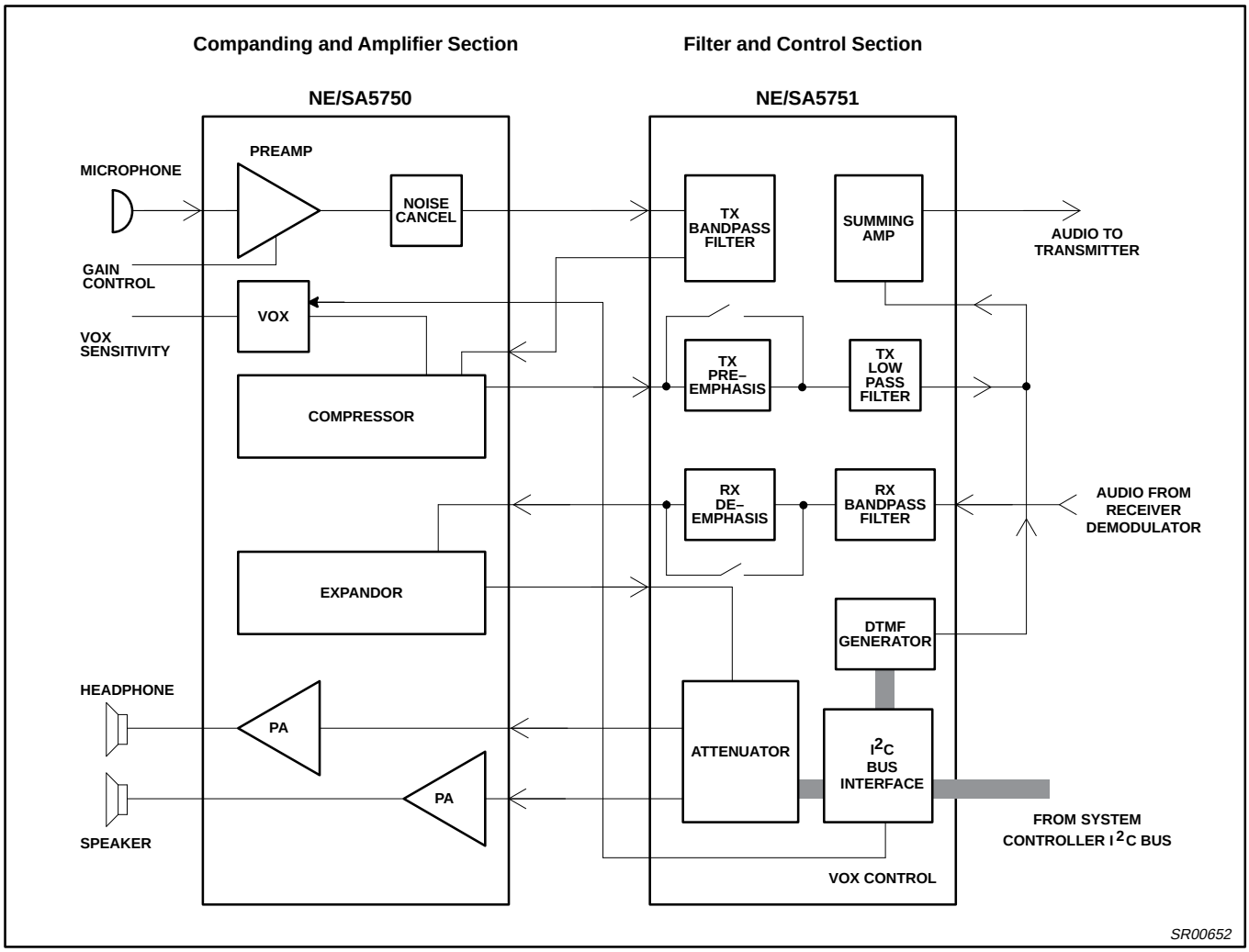

Figure 3. Typical Configuration of Audio Processor (APROC) System Chip Set

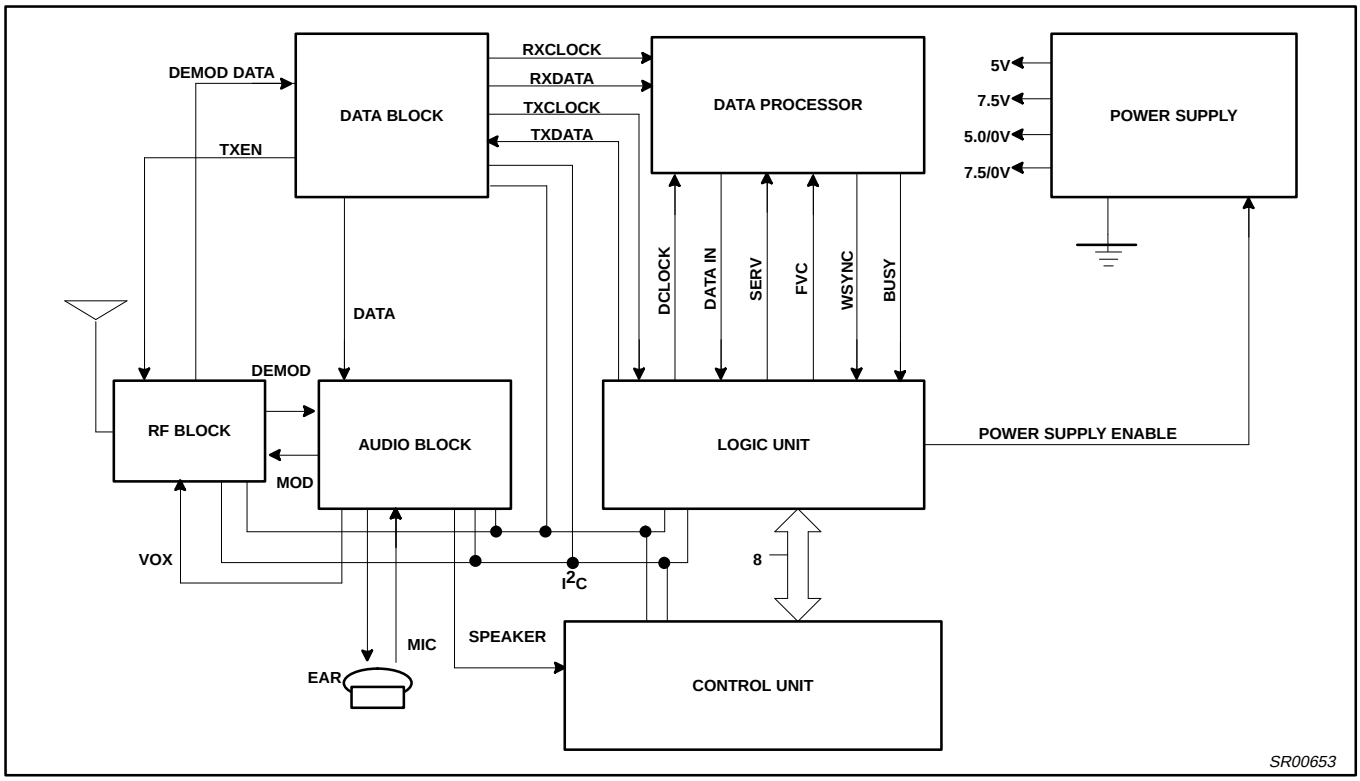

Figure 4. Cellular Radio System

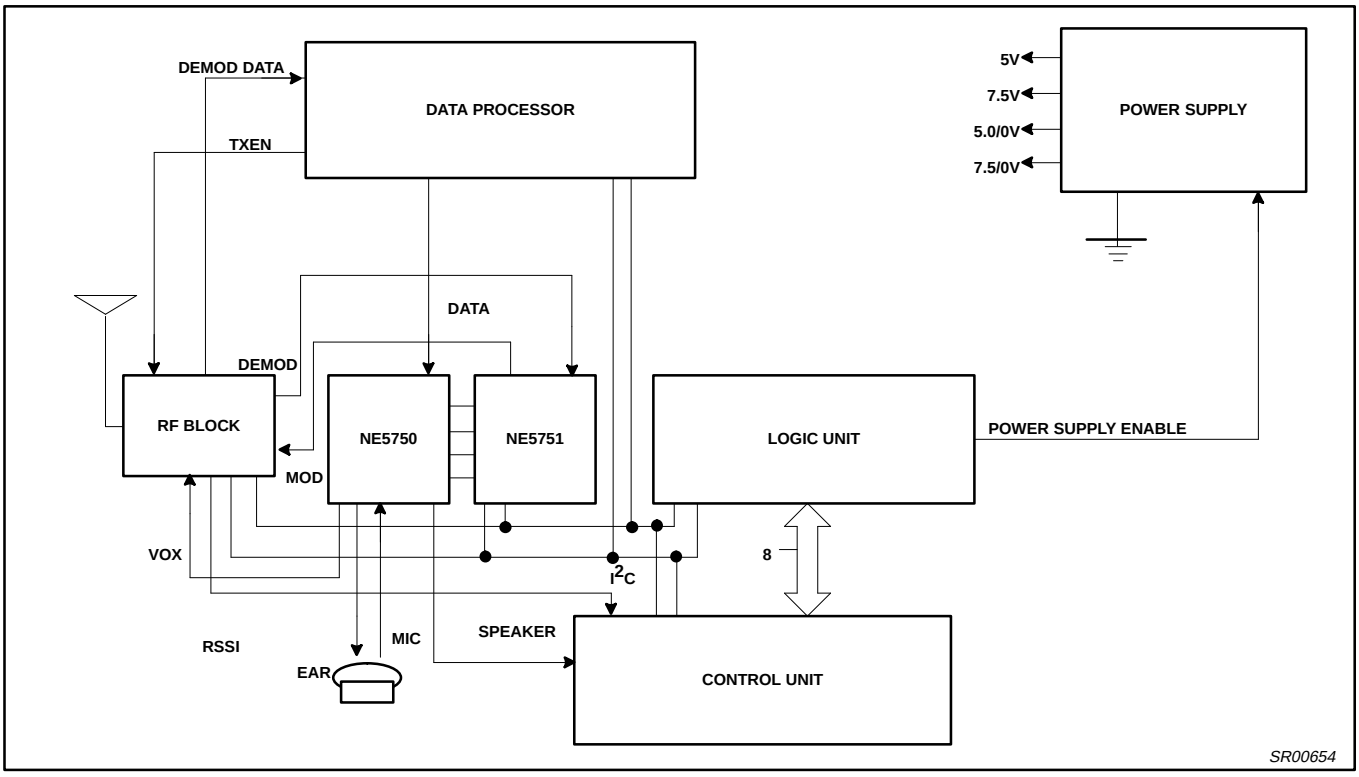

Figure 5. APROC Application Diagram

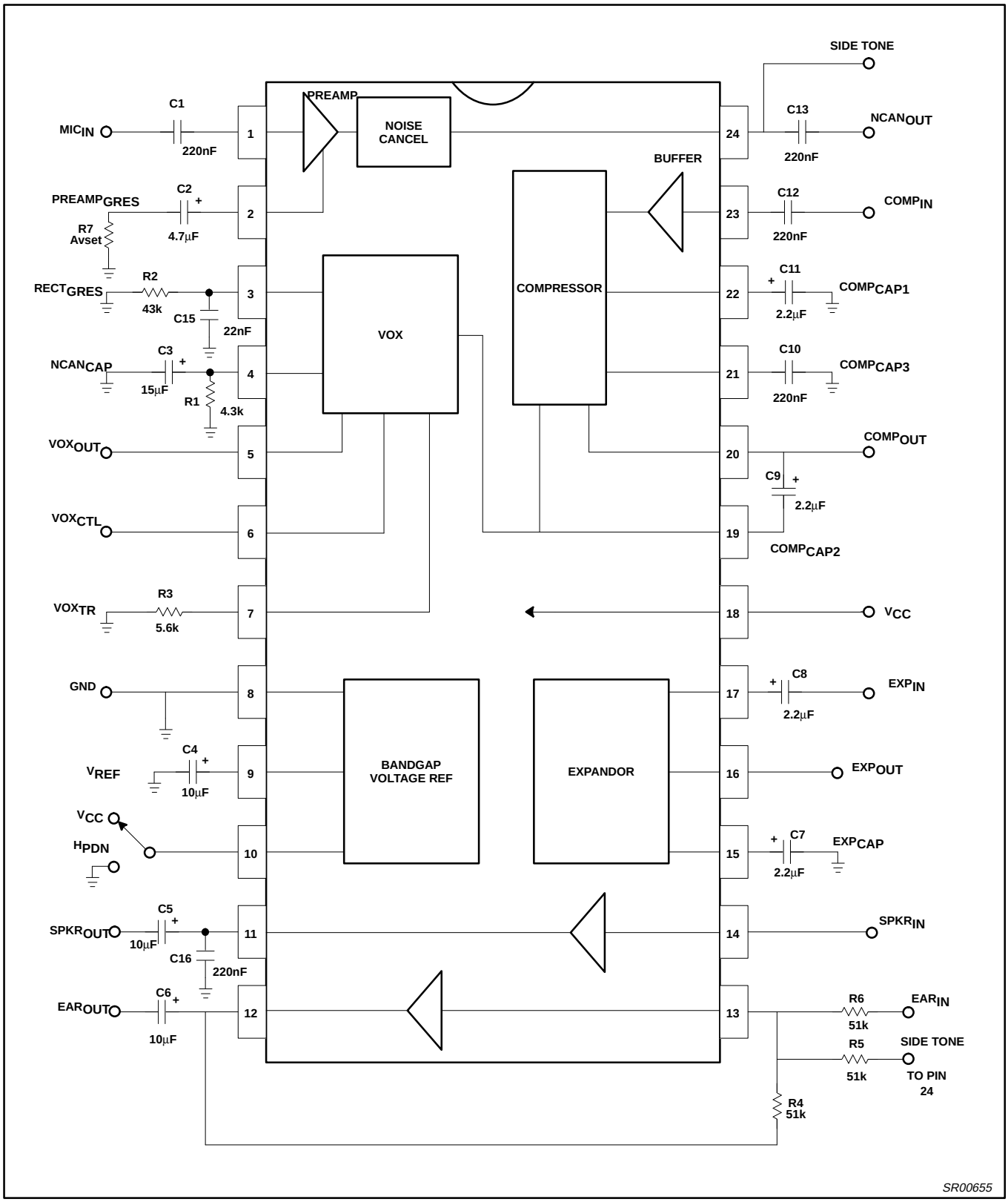

Figure 6. NE/SA5750 Test and Application Circuit